

CLAIMS

1. A prepolymer, prepared by reacting a mixture comprising:
  - (a) at least one multifunctional compound,
  - (b) at least one diisocyanate, and
  - (c) at least one diol,  
wherein said diol has a weight average molecular weight of at most 7000,  
said prepolymer has a viscosity of at most 100,000 cps at 70°C, and  
10 said prepolymer, when reacted with an excess of water, forms a hydrogel polymer.
2. A prepolymer, prepared by reacting a mixture comprising:
  - (a) at least one triisocyanate,
  - (b) at least one diisocyanate, and
  - (c) at least one polyalkylene oxide,  
wherein a molar ratio of (a):(b):(c) in said mixture is 0.9-1.1:1.8-3.3:1.2-3.3,  
said at least one polyalkylene oxide has a weight average molecular weight of at most 7000, and  
20 said prepolymer, when reacted with an excess of water, forms a hydrogel polymer.
3. A prepolymer, prepared by reacting a mixture comprising:
  - (a) at least one triol,
  - (b) at least one diisocyanate, and
  - (c) at least one polyalkylene oxide,  
wherein a molar ratio of (a):(b):(c) in said mixture is 0.9-1.1:1.8-2.2:4.5-5.5,  
said at least one polyalkylene oxide has a weight average molecular weight of at most 7000, and  
25

said prepolymer, when reacted with an excess of water, forms a hydrogel polymer.

4. The prepolymer of Claim 2, wherein said molar ratio of (a):(b):(c) in said mixture is 0.97-1.1.03:1.94-2.06:1.94-2.06, and

5           said at least one polyalkylene oxide has a weight average molecular weight of 1000-2000.

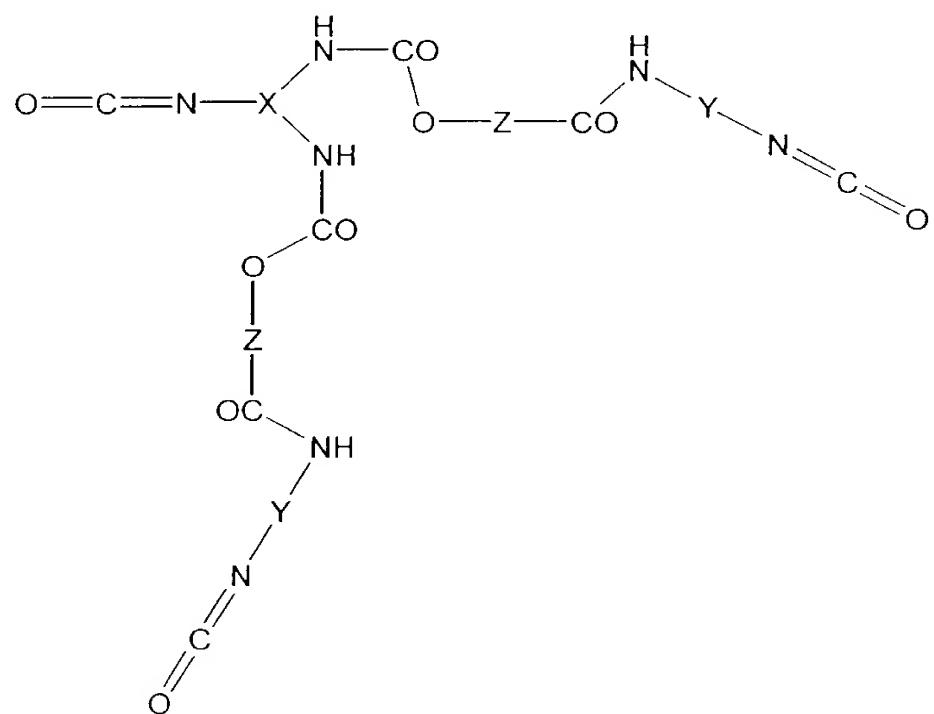
5. The prepolymer of Claim 3, wherein said molar ratio of (a):(b):(c) in said mixture is 0.97-1.1.03:1.94-2.06:4.85-5.15, and

10           said at least one polyalkylene oxide has a weight average molecular weight of 1000-2000.

6. The prepolymer of Claim 4, wherein said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.

7. The prepolymer of Claim 5, wherein said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.

15           8. A prepolymer of formula I:



Formula I

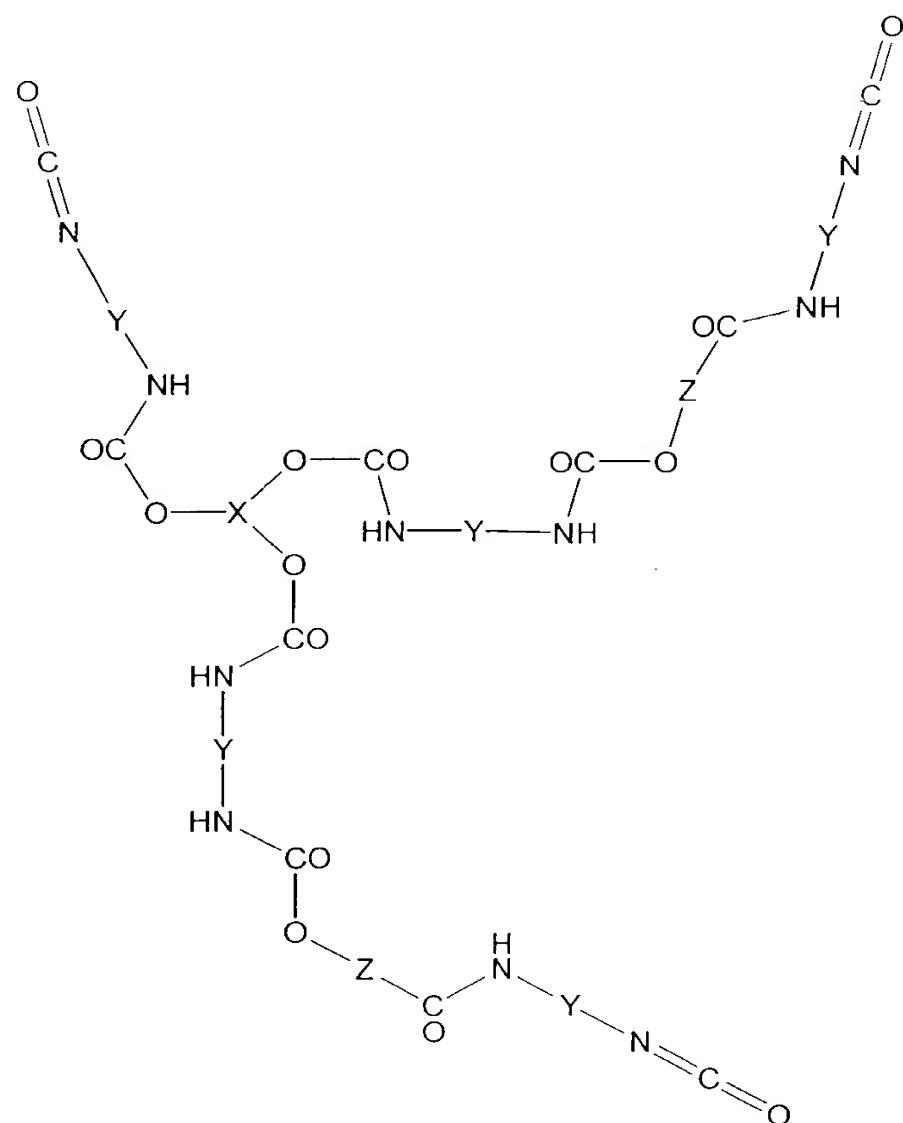
wherein X is a trivalent organic group containing 3-20 carbon atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

5 Z is an oligomer consisting of monomer units selected from the group consisting of -(CH<sub>2</sub>-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>3</sub>)-O)-, -(CH(CH<sub>3</sub>)-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>2</sub>-CH<sub>3</sub>)-O)-, -(CH(CH<sub>2</sub>-CH<sub>3</sub>)-CH<sub>2</sub>-O)- and -(CH(CH<sub>3</sub>)-CH(CH<sub>3</sub>)-O)-, and

Z has a weight average molecular weight of at most 7000.

10 9. A prepolymer of formula II:



Formula II

wherein X is a trivalent organic group containing 3-20 carbon atoms;

5 Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the group consisting of -(CH<sub>2</sub>-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>3</sub>)-O)-, -(CH(CH<sub>3</sub>)-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>2</sub>-CH<sub>3</sub>)-O)-, -(CH(CH<sub>2</sub>-CH<sub>3</sub>)-CH<sub>2</sub>-O)- and -(CH(CH<sub>3</sub>)-CH(CH<sub>3</sub>)-O)-, and

10 Z has a weight average molecular weight of at most 7000.

10. The prepolymer of Claim 8, wherein  
Y is a divalent aliphatic group,  
Z has a weight average molecular weight of 1000-2000, and  
said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.
- 5 11. The prepolymer of Claim 9, wherein  
Y is a divalent aliphatic group,  
Z has a weight average molecular weight of 1000-2000, and  
said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.
- 10 12. A mixture, comprising:
  - (i) water, and
  - (ii) the prepolymer of Claim 2.
13. A mixture, comprising:
  - (i) water, and
  - (ii) the prepolymer of Claim 3.
- 15 14. A mixture, comprising:
  - (i) water, and
  - (ii) the prepolymer of Claim 8.
- 15 15. A mixture, comprising:
  - (i) water, and
  - (ii) the prepolymer of Claim 9.
- 20 16. The mixture of Claim 12, consisting essentially of:
  - (i) said water, and
  - (ii) said prepolymer.
17. The mixture of Claim 13, consisting essentially of:
  - (i) said water, and
  - (ii) said prepolymer.

18. The mixture of Claim 14, consisting essentially of:  
(i) said water, and  
(ii) said prepolymer.

5 19. The mixture of Claim 15, consisting essentially of:  
(i) said water, and  
(ii) said prepolymer.

20. The mixture of Claim 12, wherein said mixture has a viscosity of  
15 to 500 cps at 50°C.

10 21. The mixture of Claim 13, wherein said mixture has a viscosity of  
15 to 500 cps at 50°C.

22. The mixture of Claim 14, wherein said mixture has a viscosity of  
15 to 500 cps at 50°C.

23. The mixture of Claim 15, wherein said mixture has a viscosity of  
15 to 500 cps at 50°C.

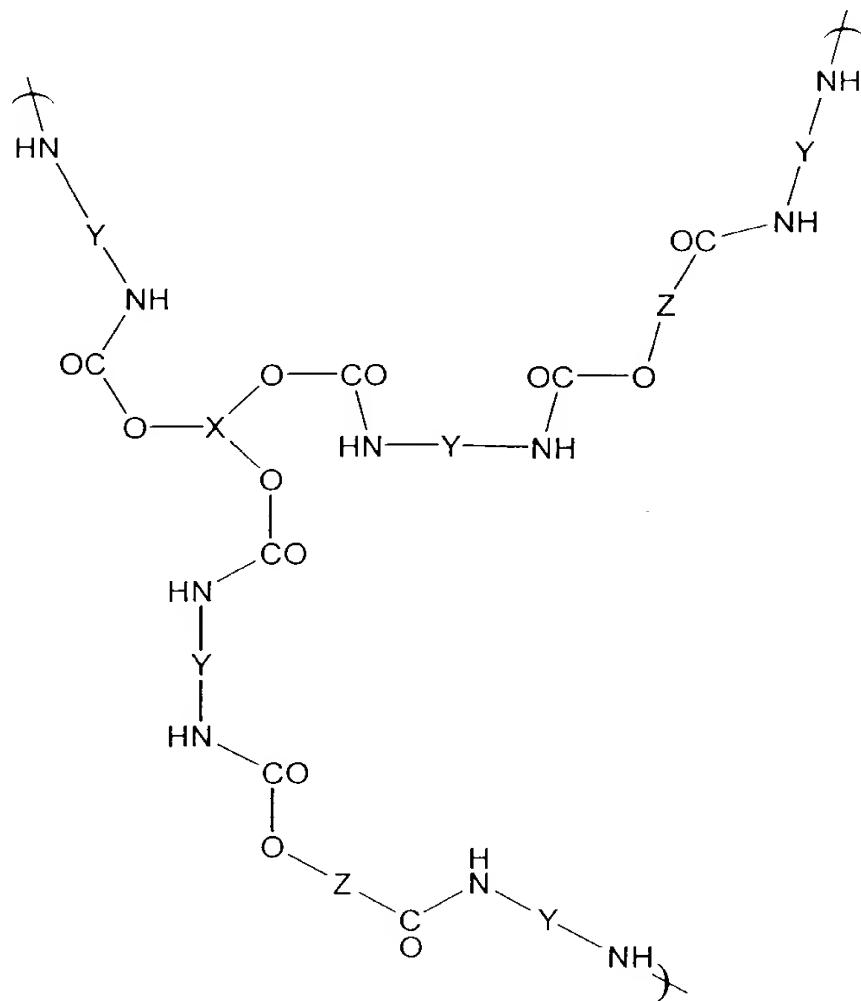
15 24. A polyurethane hydrogel, prepared by reacting the prepolymer  
of Claim 2 with an excess of water.

25. A polyurethane hydrogel, prepared by reacting the prepolymer  
of Claim 3 with an excess of water.

20 26. A polyurethane hydrogel, prepared by reacting the prepolymer  
of Claim 8 with an excess of water.

27. A polyurethane hydrogel, prepared by reacting the prepolymer  
of Claim 9 with an excess of water.

28. A polyurethane hydrogel, comprising units of formula III



Formula III

wherein X is a trivalent organic group containing 3-20 carbon

5 atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

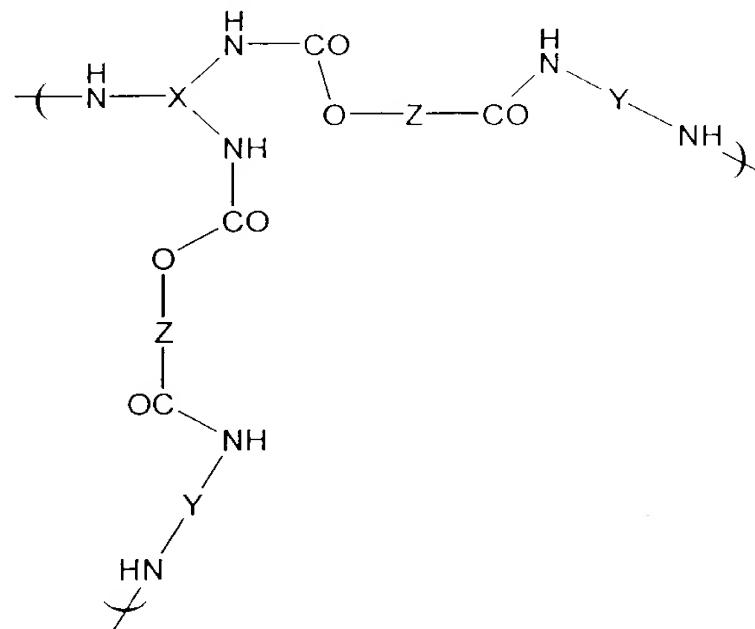
10

Z is an oligomer consisting of monomer units selected from the group consisting of -(CH<sub>2</sub>-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>3</sub>)-O)-, -(CH(CH<sub>3</sub>)-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>2</sub>-CH<sub>3</sub>)-O)-, -(CH(CH<sub>2</sub>-CH<sub>3</sub>)-CH<sub>2</sub>-O)- and -(CH(CH<sub>3</sub>)-CH(CH<sub>3</sub>)-O)-,

and

Z has a weight average molecular weight of at most 7000.

29. A polyurethane hydrogel, comprising units of formula VI



Formula VI

wherein X is a trivalent organic group containing 3-20 carbon

5 atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the group consisting of -(CH<sub>2</sub>-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>3</sub>)-O)-, -(CH(CH<sub>3</sub>)-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>2</sub>-CH<sub>3</sub>)-O)-, -(CH(CH<sub>2</sub>-CH<sub>3</sub>)-CH<sub>2</sub>-O)- and -(CH(CH<sub>3</sub>)-CH(CH<sub>3</sub>)-O)-,  
10 and

Z has a weight average molecular weight of at most 7000.

30. The polyurethane hydrogel of Claim 28, wherein

Y is a divalent aliphatic group, and

Z has a weight average molecular weight of 1000-2000.

- 15 31. The polyurethane hydrogel of Claim 29, wherein

Y is a divalent aliphatic group, and

Z has a weight average molecular weight of 1000-2000.

32. A contact lens, comprising the polyurethane hydrogel of  
Claim 24.
33. A contact lens, comprising the polyurethane hydrogel of  
Claim 25.
- 5 34. A contact lens, comprising the polyurethane hydrogel of  
Claim 26.
35. A contact lens, comprising the polyurethane hydrogel of  
Claim 27.
- 10 36. A method of forming a contact lens, comprising:  
molding the mixture of Claim 12, to form a contact lens.
37. A method of forming a contact lens, comprising:  
molding the mixture of Claim 13, to form a contact lens.
38. A method of forming a contact lens, comprising:  
molding the mixture of Claim 14, to form a contact lens.
- 15 39. A method of forming a contact lens, comprising:  
molding the mixture of Claim 15, to form a contact lens.
40. The method of Claim 36, wherein said contact lens is formed in  
a fully hydrated state.
- 20 41. The method of Claim 37, wherein said contact lens is formed in  
a fully hydrated state.
42. The method of Claim 38, wherein said contact lens is formed in  
a fully hydrated state.
43. The method of Claim 39, wherein said contact lens is formed in  
a fully hydrated state.

44. A method of forming a contact lens, comprising:  
molding a mixture comprising (a) a prepolymer, and (b) water, to  
a contact lens,

wherein said contact lens comprises a polyurethane hydrogel.

and

said contact lens is formed in a fully hydrated state.

45. The method of Claim 44, wherein said prepolymer has a viscosity of at most 100,000 cps at 70°C.

46. The prepolymer of Claim 44, wherein said prepolymer has a viscosity of 1000 to 50,000 cps at 70°C.

10

47. The method of Claim 36, wherein said molding is carried out with a circular turntable installation having a plurality of molding stations

48. The method of Claim 37, wherein said molding is carried out with a circular turntable installation having a plurality of molding stations

15

49. The method of Claim 38, wherein said molding is carried out with a circular turntable installation having a plurality of molding stations.

50. The method of Claim 39, wherein said molding is carried out with a circular turntable installation having a plurality of molding stations

20

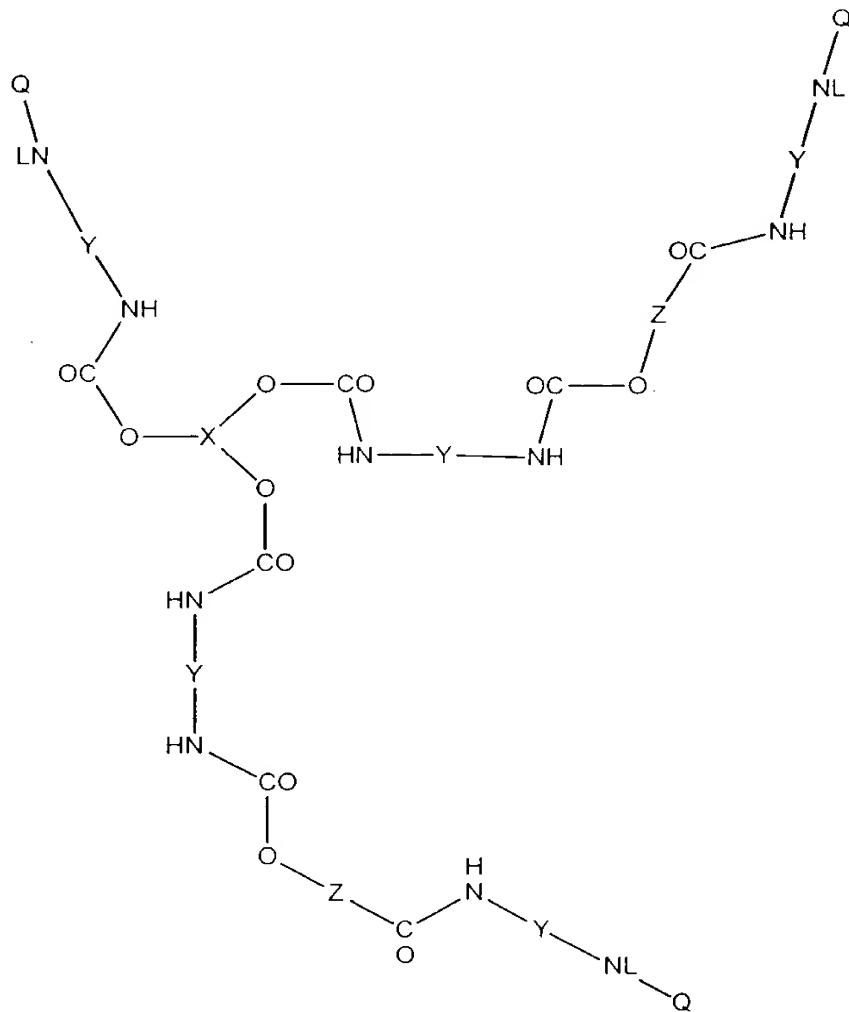
51. The method of Claim 44, wherein said molding is carried out with a circular turntable installation having a plurality of molding stations

52. The method of Claim 45, wherein said molding is carried out with a circular turntable installation having a plurality of molding stations.

25

54. The method of Claim 53, wherein said injection molding is reactive injection molding.

55. A precursor to a polyurethane hydrogel having Formula (VIII):



### Formula (VIII)

wherein X is a trivalent organic group containing 3-20 carbon atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

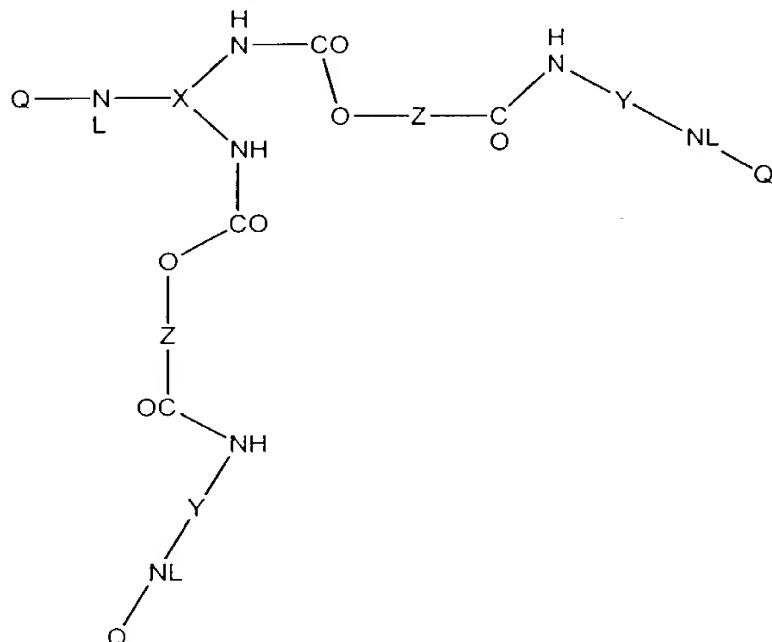
Z is an oligomer consisting of monomer units selected from the

group consisting of -(CH<sub>2</sub>-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>3</sub>)-O)-, -(CH(CH<sub>3</sub>)-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>2</sub>-CH<sub>3</sub>)-O)-, -(CH(CH<sub>2</sub>-CH<sub>3</sub>)-CH<sub>2</sub>-O)- and -(CH(CH<sub>3</sub>)-CH(CH<sub>3</sub>)-O)-, and

Z has a weight average molecular weight of at most 7000,  
L is either hydrogen or forms a double bond, and Q is selected  
from the group consisting of carboxylic acid, hydrogen and O=C, provided that  
when Q is O=C, L forms a double bond between nitrogen and the carbon  
atom of the carbonyl.

5

56. A precursor to a polyurethane hydrogel having Formula (IX):



Formula (IX)

10 wherein X is a trivalent organic group containing 3-20 carbon atoms;

Y is a divalent organic group containing 3-20 carbon atoms;

Z is an oligomer consisting of monomer units selected from the group consisting of -(CH<sub>2</sub>-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>3</sub>)-O)-, -(CH(CH<sub>3</sub>)-CH<sub>2</sub>-O)-, -(CH<sub>2</sub>-CH(CH<sub>2</sub>-CH<sub>3</sub>)-O)-, -(CH(CH<sub>2</sub>-CH<sub>3</sub>)-CH<sub>2</sub>-O)- and -(CH(CH<sub>3</sub>)-CH(CH<sub>3</sub>)-O)-, and

15

Z has a weight average molecular weight of at most 7000,

L is either hydrogen or forms a double bond, and Q is selected from the group consisting of carboxylic acid, hydrogen and O=C, provided that

when Q is O=C, L forms a double bond between nitrogen and the carbon atom of the carbonyl.